**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, DC**

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|---|---|---|
| In the Matter of Use of Spectrum Bands Above 24 GHz For Mobile Radio Services | ) | GN Docket No. 14-177 |
| Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands | ) | IB Docket No. 15-256 |
| Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band | ) | RM-11664 |
| Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services | ) | WT Docket No. 10-112 |
| Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations | ) | IB Docket No. 97-95 |

# REPLY COMMENTS OF NEXTLINK WIRELESS, LLC

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## Executive Summary

Nextlink agrees with Chairman Wheeler's assessment that "[o]pening up spectrum and offering flexibility to operators and innovators is the most important thing we can do to enable the 5G revolution." In this spirit, several commenters, including Nextlink, urge the Federal Communications Commission ("FCC" or "Commission") to make additional bands of millimeter-wave ("mmWave") spectrum available for fifth-generation ("5G") services. Multiple parties agree with Nextlink that the remaining portions of the LMDS 28 GHz band, including the A2 band (29.10-29.25 GHz), A3 band (31.075-31.225 GHz), and B block (31.00-31.075 and 31.225-31.30 GHz) are ideal candidates for 5G. The 28 GHz band is already allocated for mobile use, is lower in frequency than most of the other bands the FCC identified in the *Further Notice*, and is well suited for next-generation services.

Adopting mobile service rules for additional targeted spectrum bands will create secondary benefits as well. Samsung, Ericsson and Verizon all agree that adopting mobile service rules for bands in close proximity to the 28, 37, and 39 GHz bands will accelerate technology development, create economies of scale, and minimize the number of 3GPP band classes user equipment will need to support. Thus, the entire 28 GHz Upper Microwave Flexible Use Service ("UMFUS") ecosystem would benefit from mobile service rules for the smaller swaths of spectrum available in the 28 GHz A2 and A3 bands and B block. Nextlink is not aware of any technical impediment to adopting mobile service rules for the remaining portions of the LMDS band, and none of the comments in response to the *Further Notice* explicitly oppose targeting the remaining portions of the 28 GHz band for 5G. Indeed, several commenters agree that, in certain circumstances, adopting smaller channel sizes is preferable to not adopting mobile service rules for additional mmWave spectrum at all. The FCC can promote a fertile marketplace for equipment manufacturers by leveraging current synergies among these bands and adopting mobile service rules for the 28 GHz A2 and A3 bands and B block.

Commenters also agree with Nextlink that the FCC's performance requirements for mmWave bands should encourage innovation, experimentation, and investment. Stakeholders urge the FCC to pursue a balanced approach to performance rules that provides licensees with certainty while remaining flexible enough to evolve as 5G standards and business cases develop.

Nextlink encourages the FCC to reject uncertain "use-or-share" rules for the UMFUS bands. Mobile network operators, equipment manufacturers, and trade associations oppose use-or-share rules with near unanimity. If, however, the FCC does move forward with use-or-share rules, it should limit application of those rules to the 24 GHz and 37 GHz bands so that stakeholders can observe how these rules impact mmWave operations in practice. At a minimum, the FCC's use-or-share framework should encourage investment in mmWave bands and protect incumbents' existing license rights.

Finally, commenters agree that the FCC should consider exercising regulatory restraint with regard to several of its proposed technical rules for the UMFUS bands. The record indicates that the FCC should (1) forego antenna restrictions on UMFUS licensees, including height limitations or downtilt requirements; (2) reject calls to impose minimum bandwidth requirements on mobile and transportable station transmit power levels; (3) not base fixed point-

to-point coordination requirements on distance alone; and (4) limit its operability rules to technically feasible requirements that take into account incumbent licensees' existing operations.

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## REPLY COMMENTS OF NEXTLINK WIRELESS, LLC

Nextlink Wireless, LLC ("Nextlink"), submits these reply comments in response to the Federal Communications Commission's ("FCC's" or "Commission's") Further Notice of Proposed Rulemaking ("*Further Notice*") in the above-captioned proceedings.[1]

[1] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.,* Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd. 8014 (2016) ("*Report and Order*" or "*Further Notice*").

## INTRODUCTION

The record in this proceeding confirms that the FCC can maximize innovation and investment in 5G by adopting mobile service rules for as many millimeter-wave ("mmWave") bands as technically possible. In particular, multiple commenters agree that the FCC should consider adopting mobile service rules for spectrum bands not specifically identified in the *Further Notice*, such as the 28 GHz A2 and A3 bands and B block. Adopting mobile service rules for the remaining portions of the 28 GHz band will create an equipment ecosystem that accelerates technology development and promotes economies of scope and scale.

The FCC's licensing rules for mmWave bands will help determine the overall success of 5G, and there is widespread support in the record for Nextlink's proposals on how the Commission can promote 5G services and technologies. For example, balanced performance requirements will encourage innovation and investment in mmWave bands. Licensees would benefit from technology-neutral performance safe harbors that the FCC can also recalibrate periodically to account for evolution in 5G services and technologies. Similarly, the FCC should reject its controversial "use-or-share" rules. At a minimum, the FCC should limit use-or-share rules to the 24 GHz and 37 GHz bands, or adopt use-or-share rules that promote investment in the UMFUS bands and preserve the *status quo* for incumbent licensees. Commenters also agree with Nextlink that the FCC should not adopt technical rules that may hamper the development of 5G.

Nextlink once again applauds the FCC for its diligent work to create a launching pad for 5G and urges the FCC to make the targeted revisions to its proposed rules that Nextlink and others recommend in their comments. With the right policies in place, the United States will lead the global transition to 5G.

## DISCUSSION

### I. THE RECORD SUPPORTS ADOPTING MOBILE SERVICE RULES FOR ADDITIONAL BANDS, INCLUDING THE 28 GHZ A2 AND A3 BANDS AND B BLOCK

The record in this proceeding confirms Chairman Wheeler's prior assessment that "[o]pening up spectrum and offering flexibility to operators and innovators is the most important thing we can do to enable the 5G revolution . . . ."[2] Commenters urge the Commission not only to open the bands identified in the *Further Notice* for 5G, but also to consider additional bands for next-generation services. AT&T and CTIA, for example, both recommend that the Commission allocate more spectrum below 6 GHz for wireless use (including 5G).[3] Several equipment manufacturers, including Ericsson, Nokia, and Qualcomm, call on the Commission to consider other bands of spectrum for 5G, including spectrum below 1 GHz, between 3 and 5 GHz, and between 6 and 24 GHz.[4] The MVDDS 5G Coalition, meanwhile, asks the

[2] *See Report and Order*, 31 FCC Rcd. at 8271 (Statement of Chairman Tom Wheeler); *see also id.* at 8275 (Statement of Commissioner Jessica Rosenworcel) (noting that "for 5G technology to takeoff, for the United States to win this race, we need spectrum—and lots of it."); *id.* at 8278-79 (Statement of Commissioner Ajit Pai, Approving in Part and Concurring in Part) (remarking that in Commissioners Pai and O'Rielly's view, "the Commission should have teed up as many bands as possible and let innovators and entrepreneurs tell us what might work."); *id.* at 8281 (Statement of Commissioner Michael O'Rielly) ("I appreciate that the item . . . seeks comment, in the further notice, on seven new bands to open up for additional wireless uses. However, I am sure that no one is surprised that I will continue to push for even more bandwidth.").

[3] Comments of AT&T, GN Docket No. 14-177, *et al.*, at 4 (filed Sept. 30, 2016) ("AT&T Comments"); Comments of CTIA, GN Docket No. 14-177, *et al.*, at 7-8 (filed Sept. 30, 2016) ("CTIA Comments").

[4] Comments of Ericsson, GN Docket No. 14-177, *et al.*, at 5-8 (filed Sept. 30, 2016) ("Ericsson Comments"); Comments of Nokia, GN Docket No. 14-177, *et al.*, at 5-6 (filed Sept. 30, 2016) ("Nokia Comments"); Comments of Qualcomm Inc., GN Docket No. 14-177, *et al.*, at 2-3 (filed Sept. 30, 2016) ("Qualcomm Comments").

Commission to adopt mobile service rules for the 12 GHz band.[5] The 12.2-12.7 GHz band features 500 megahertz of contiguous spectrum that is well suited for mobile broadband use.[6] Vendors have extensive experience producing large volumes of equipment for the 12 GHz band, and the propagation characteristics of the 12 GHz band will allow for 5G deployments using fewer cells with better indoor signal penetration than possible using higher frequency bands.[7] Establishing a more flexible regulatory framework that permits 5G deployments in the 12 GHz band would increase investment and has the potential to catalyze 5G services in higher frequency bands. Nextlink agrees with the MVDDS 5G Coalition and other commenters that the Commission should look holistically at all available spectrum bands and take advantage of as many bands that the Commission can allocate for 5G service as possible.

As Nextlink demonstrated in its comments, there are several clear benefits to adopting mobile service rules for additional spectrum bands not specifically listed in the *Further Notice*, including the 28 GHz A2 and A3 bands and B block. The 28 GHz band is already allocated for mobile use, is lower in frequency than most of the other bands that the FCC identified in the *Further Notice*, and is well-suited for next-generation services. Meanwhile, not adopting mobile service rules for the remaining segments of the LMDS band would orphan this spectrum and potentially create regulatory confusion for incumbent and new licensees.

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[5] *See generally* Comments of MVDDS 5G Coalition, GN Docket No. 14-177, *et al*. at ii (filed Sept. 30, 2016) ("MVDDS 5G Coalition Comments") (noting that the propagation characteristics of the 12 GHz band "will permit operators to establish service coverage of a wide area with a more limited capital investment and with fewer recurring expenses than possible on higher-frequency spectrum.").

[6] *See MVDDS 5G Coalition Petition for Rulemaking to Permit MVDDS Use of the 12.2-12.7 GHz Band for Two-Way Mobile Broadband Service*, Petition of MVDDS 5G Coalition for Rulemaking, RM-11768 (filed Apr. 26, 2016).

[7] *See* MVDDS 5G Coalition Comments at 3-21.

The record supports Nextlink's assessment. Multiple parties urge the FCC to look broadly and maximize the number of bands it identifies for mobile services, including the remaining portions of the LMDS band. Indeed, no one has opposed adopting mobile service rules for the A2 and A3 bands and B block. Nextlink therefore urges the FCC to adopt mobile service rules for the remaining portions of the LMDS band.

### A. Commenters agree that the 28 GHz A2 and A3 bands and B block are premier candidates for flexible use rules.

The record confirms that the 28 GHz A2 and A3 bands and B block are ideal candidates for mobile service.[8] Straight Path Communications, Inc. ("Straight Path"), for example, urges the FCC to "extend its UMFUS framework throughout more of the LMDS band," including the A3 band and B block.[9] Straight Path agrees with Nextlink that the LMDS spectrum meets most of the FCC's *Spectrum Frontiers* criteria.[10] Verizon similarly notes that repurposing the remaining portions of the LMDS spectrum for mobile service would "promote synergies with 5G operations using the A1 sub-block."[11] Verizon also shares Nextlink's concern that if the FCC does not allow 5G services in the A2 and A3 bands, then licensees that hold the entire A block

[8] *See* Verizon's Comments on Further Notice, GN Docket No. 14-177, *et al.*, at 4-5 (filed Sept. 30, 2016) ("Verizon Comments"); Comments of Straight Path Communications Inc., GN Docket No. 14-177, *et al.*, at 3-5 (filed Sept. 30, 2016) ("Straight Path Comments"); *see also* Comments of Nextlink Wireless, LLC, GN Docket No. 14-177, *et al.* at 4 (filed Sept. 30, 2016) ("Nextlink Comments") (noting that the 28 GHz band "has lower atmospheric absorption than higher mmWave frequencies" and is "substantially unaffected by rain attenuation and oxygen loss, and may offer better propagation conditions than today's cellular network throughout each cell.").

[9] Straight Path Comments at 3.

[10] *Id.* at 4-5 (noting that "[t]he Commission's rationale for authorizing mobile operating rights in the 28 GHz band applies to the LMDS A3 and B bands").

[11] Verizon Comments at 5.

(including the A1, A2, and A3 bands) will be forced to "inefficiently bifurcate their operations—under a single license—into 5G and non-5G [services]."[12] Thus, the FCC's failure to adopt mobile service rules for the entire LMDS band would create significant technical, regulatory, and operational problems for licensees like Nextlink, such as challenges accessing equipment and demonstrating compliance with performance requirements.

Other parties support FCC action on bands near in frequency to the 28 GHz band, which further confirms the viability of spectrum near, in, and around 28 GHz for 5G services. Samsung explains that "spectrum near the 28 GHz and 37-40 GHz bands already allocated within the mmWave range will be particularly useful" for 5G services.[13] Samsung supports the FCC's proposal to include the 24, 32, and 42 GHz bands in UMFUS licensing, but "does not object to other bands" also being used for mobile services.[14] CTIA similarly urges the FCC to consider other mmWave bands for mobile use as wireless services grow more advanced and spectrum becomes increasingly scarce.[15]

### B. Mobile service rules in the LMDS band would support the growth of nearby bands.

Adopting mobile service rules for the remaining portions of the LMDS band would also promote the growth of services in other nearby bands. As noted above, Samsung supports the FCC's proposal to adopt UMFUS service rules for several bands in "fairly close proximity" to the 28, 37, and 39 GHz bands because "this proximity will accelerate technology development"

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[12] *Id.*

[13] Comments of Samsung Electronics America, Inc. and Samsung Research America, GN Docket No. 14-177, *et al.*, at 4 (filed Sept. 30, 2016) ("Samsung Comments").

[14] *Id.* at 4-5.

[15] *See* CTIA Comments at 6.

and minimize the number of 3GPP band classes user equipment will need to support.[16] Verizon similarly argues that "[e]quipment that is developed and manufactured for 5G use in the A1 frequencies could readily be designed to also take advantage of the additional capacity by using the A2, A3, B1, and B2 frequencies, but only if the Commission adds those frequencies to the spectrum that is repurposed in this proceeding for 5G use."[17]

Ericsson likewise asks the FCC to consider "'tuning range' solutions" that can harmonize adjacent or nearly-adjacent bands so long as the equipment can be reconfigured to operate over multiple bands.[18] As Ericsson notes, "[t]he benefits of global harmonization are not limited to situations where all regions have identical spectrum allocations."[19] Ericsson's proposal is a smart solution to the ever-growing spectrum crunch and would ensure that spectrum bands that may not be globally harmonized are nonetheless usable in particular jurisdictions. Ericsson's "tuning range" concept would allow equipment manufacturers to take advantage of global economies of scale while still respecting allocation determinations of differing regions around the world.

The FCC therefore should broaden its attention to spectrum bands close in proximity to the 28, 37, and 39 GHz bands, thereby allowing a vibrant marketplace to develop. Mobile network operators, trade associations, and equipment manufacturers have all asked the Commission to consider spectrum bands in addition to those identified in the *Further Notice* for 5G use. The first step in this process is to adopt mobile service rules for the remaining portions

[16] Samsung Comments at 4-5.

[17] Verizon Comments at 5.

[18] Ericsson Comments at 4.

[19] *Id*.

of the LMDS band to make them attractive to global equipment manufacturers and other key players in the burgeoning 5G ecosystem.

Chairman Wheeler has previously characterized 5G as a "national priority" for the United States, and explained that "we must lead the world."[20] The Chairman called it "beyond disappointing" that intransigent interests blocked the International Telecommunication Union from identifying the 28 GHz band for 5G study and declared the "clear plan for the United States and other countries" interested in making greater use of this spectrum is to "roll up our sleeves to make sharing possible in these bands."[21]

Nextlink shares the Chairman's sentiments and agrees with CTIA that "[e]nsuring that spectrum allocation and deployment keep pace with growing consumer demands will be critical in maintaining the United States' position as the world's foremost wireless leader."[22] The FCC can take a significant step towards that goal by heeding the calls of commenters to target additional bands for 5G and allow the remaining portions of the LMDS band to reach their full potential.

### C. Technical solutions are available to ensure that valuable mmWave spectrum resources are fully utilized and that a 5G equipment ecosystem is fully supported.

#### 1. The FCC can adopt mobile service rules for spectrum bands smaller than 200 megahertz in bandwidth.

The record establishes that service providers can deploy next-generation services over channel bandwidths less than 200 megahertz in size. Indeed, the FCC implicitly acknowledged

[20] Hon. Tom Wheeler, Chairman, FCC, Remarks at the 19th Annual Satellite Leadership Dinner, at 3 (Mar. 7, 2016), https://apps.fcc.gov/edocs_public/attachmatch/DOC-338135A1.pdf.

[21] *Id.* at 3, 4.

[22] CTIA Comments at 6.

that 200 megahertz channels are not required when it suggested that it could license the 24 GHz band in 100 megahertz channels.[23] Potential licensees would benefit from access to smaller swaths of spectrum—particularly when the alternative would be to completely foreclose access to harmonized spectrum. The Commission therefore should not foreclose mobile service rules in the 28 GHz A2 and A3 bands and B block merely because the channel sizes would be less than 200 megahertz.

Larger channel sizes are not necessary to achieve 5G data speeds and capacity requirements. For example, the Telecommunications Industry Association ("TIA") recognizes that "pre-existing circumstances in particular bands may occasionally require creating 100 MHz blocks."[24] TIA explains that (1) modifying UMFUS radios, (2) "half-clocking," (3) aggregating multiple 100 megahertz bands at a later time, and (4) eliminating the restrictions that necessitated the smaller channels in the first place are all options for deploying next-generation services over smaller channel blocks.[25] 5G Americas similarly advocates that "a 100 MHz license increment size . . . is a reasonable compromise between complexity and usability" in the 37 GHz lower band segment.[26]

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[23] *See Further Notice* ¶ 385.

[24] Comments of the Telecommunications Industry Association, GN Docket No. 14-177, *et al.*, at 5 (filed Sept. 30, 2016) ("TIA Comments"). TIA represents companies that manufacture and supply the products and services used in global communications across various technology platforms. *Id.* at 1, n.1.

[25] *Id.* at 5-6.

[26] Comments of 5G Americas, GN Docket No. 14-177, *et al*. at 12 (filed Sept. 30, 2016) ("5G Americas Comments"). 5G Americas' membership includes wireless operators and vendors focused on deploying LTE and developing 5G throughout the Americas. *Id.* at 1.

Cambridge Broadband Networks Limited ("CBNL") also asks the FCC to create two, 100 megahertz channels in the 39 GHz band.[27] CBNL notes that existing 39 GHz band service providers use a 700 megahertz transmit-receive spacing, and licensees using the 38.6-38.8 GHz portion of the band would need to purchase three, 200 megahertz blocks to continue their existing operations under the FCC's band plan.[28] To "equalize[] the minimum investment in 39 GHz spectrum for FDD and TDD approaches," CBNL suggests that the FCC create two, 100 megahertz channel blocks at 39.2-39.3 GHz and 39.9-40.0 GHz.[29]

Nextlink agrees with commenters that the FCC should not restrict channels to larger, 200 megahertz channels and instead should license some UMFUS bands in smaller channel sizes. The 28 GHz A2 and A3 bands and B block present multiple public benefits for mobile use, and a channel size of 100 megahertz presents no impediment to such use. As Straight Path explains, "[w]hile the LMDS A3 and B bands represent only an additional 300 megahertz of spectrum, parties have pointed out that even small contiguous blocks of LMDS spectrum could prove capable of supporting innovative 5G wireless services."[30] Consumers stand to benefit from the synergies that adopting mobile service rules for the remainder of the LMDS band will create, and

[27] *See* Letter from Dr. John Naylon, CTO, Cambridge Broadband Networks Limited, GN Docket No. 14-177, *et al*. at 2 (filed Sept. 5, 2016) ("CBNL Comments"). CBNL is a leading manufacturer of point-to-multipoint wireless backhaul and access solutions. *See About CBNL*, Cambridge Broadband Networks Limited, http://cbnl.com/about-cbnl (last visited Oct. 31, 2016).

[28] *See* CBNL Comments at 1-2.

[29] *Id.* at 2. Frequency Division Duplex ("FDD") and Time Division Duplex ("TDD") are flexible duplex arrangements that will support 5G services. *See* Ericsson, 5G Radio Access: Capabilities and Technologies, at 7 (Apr. 2016).

[30] Straight Path Comments at 4.

adopting smaller channel sizes is a far preferable alternative to stranding such valuable, nearby spectrum.

### 2. Mobile services in the A3 band and B block are unlikely to interfere with neighboring services in the 31.3-31.8 GHz band.

The record also confirms that operators can deploy mobile service in the A3 band and B block without causing harmful interference to adjacent band passive services operating in the 31.3-31.8 GHz band.

Most commenters agree, for example, that exclusion zones are sufficient to protect existing Radio Astronomy Service ("RAS") sites operating in the 31.3-31.8 GHz band. T-Mobile explains that "non-federal fixed and mobile service can be deployed in a manner that protects adjacent [RAS] operations through use of exclusion and coordination zones."[31] Indeed, the National Academy of Sciences' Committee on Radio Frequencies ("CORF") acknowledges that, "[w]ith proper coordination, fixed-service operations at 32 GHz could probably protect RAS adequately."[32] The same rationale would apply equally to the 31.0-31.3 GHz spectrum on the other side of the band and to mobile operations in either the 31.0-31.3 GHz or 31.8-33.4 GHz bands. Moreover, there are only twelve existing RAS locations in remote parts of the country

[31] Comments of T-Mobile USA, Inc., GN Docket No. 14-177, *et al.*, at 12 (filed Sept. 30, 2016) ("T-Mobile Comments").

[32] Comments of the National Academy of Sciences' Committee on Radio Frequencies, GN Docket No. 14-177, *et al.*, at 8 (filed Sept. 30, 2016) ("CORF Comments"). According to CORF, "[t]he minimum distance for coordination between prospective transmitting stations and RAS sites will need to be calculated for each individual case, based on factors such as altitude and surrounding terrain." *Id.*

that operate in this spectrum,[33] and the tight radius of individual cells in a 5G mobile network operating over mmWave spectrum would allow operators to configure their networks to protect those operations from interference from mobile and base stations.[34]

The FCC can also adopt operating rules to protect Earth Exploration Satellite Services ("EESS"). According to NCTA, "an appropriate out-of-band emissions (OOBE) limit," similar to that adopted to protect EESS in the 36.0-37.0 GHz band, should protect EESS operations from any harmful interference that may be caused by mobile operations in the adjacent 32 GHz band.[35] TIA likewise agrees that well-defined operating rules should be sufficient to protect passive band services in the adjacent bands, and that guard bands are not necessary to protect these operations.[36]

Even if the FCC disagrees that OOBE limits are sufficient to protect EESS operations, it should consider other measures, such as dynamic sharing models, to protect EESS while still making these neighboring bands available for mobile use. Nextlink has several concerns with

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[33] *See* COMMITTEE ON SCIENTIFIC USE OF RADIO SPECTRUM, SPECTRUM MANAGEMENT FOR SCIENCE IN THE 21ST CENTURY 112, Table 3.1 (National Academies Press 2010), *available at* https://www.nap.edu/read/12800/chapter/5.

[34] Similarly, the FCC could apply coordination and operating rules to protect the limited number of deep-space research facilities operating in the 31.3-31.8 GHz band, which are located in remote areas of the country. *See Further Notice* ¶ 396 (*citing* Comments of the EMSA Satellite Operators Association, GN Docket No. 14-177, *et al.*, at 9 (filed Jan. 27, 2016)).

[35] Comments of NCTA – The Internet & Television Association, GN Docket No. 14-177, *et al.*, at 15 (filed Sept. 30, 2016) ("NCTA Comments").

[36] TIA Comments at 7 ("Certainly, more information regarding the specific nature of such services is required. But as a general matter, it should be possible to carefully craft UMFUS operating rules – via geographic coordination or other means – to enable UMFUS operations in the bands adjacent to services that *may* require special protection such as radio astronomy or certain passive operations. Therefore, guard bands should generally not be included in the band plans . . . .") (emphasis in original).

dynamic sharing when used as part of a "use-or-share" regime, but CORF has suggested that sharing databases could promote more efficient use of spectrum—specifically for systems such as EESS that may only require access to a particular band in a particular geographic location for a short period of time. In these limited circumstances, sharing as a mechanism to protect EESS operations would be preferable to foreclosing mobile services in the adjacent bands altogether.

As noted in Nextlink's initial comments, no party thus far has filed technical evidence in the record demonstrating that the passive services in the 31.3-31.8 GHz band cannot coexist with mobile operations in the adjacent band. If the FCC is unsure as to the feasibility of protecting passive services in the 31.3-31.8 GHz band, then it should consider additional study of the exact operating parameters necessary to protect these services before completely closing off access to these well-situated neighboring bands. But Nextlink is not aware of any technical impediment to adopting mobile service rules for the remaining portions of the LMDS band, and none of the comments in response to the *Further Notice* explicitly oppose identifying the remaining portions of the 28 GHz band for 5G.

## II. PERFORMANCE REQUIREMENTS THAT INCLUDE TECHNOLOGY-NEUTRAL SAFE HARBORS AND A RECALIBRATION MECHANISM WILL PROMOTE 5G INNOVATION

The principal challenge that the FCC faces in crafting performance requirements is that there remains significant uncertainty in precisely how 5G technologies and services will develop in the coming years. The FCC should encourage innovation and experimentation in the UMFUS bands by adopting a performance requirement regime that provides the right balance of regulatory guidance and flexibility in the face of such uncertainty. Adopting performance safe harbors rather than restrictive metrics will keep the UMFUS spectrum bands open to a wide

range of uses and deployment scenarios, and adopting a recalibration mechanism will help ensure that this approach remains appropriate as 5G technologies develop.

### A. There is strong support in the record for safe harbors like those proposed by Nextlink.

The UMFUS bands are expected to support many different types of equipment, devices, and uses. The *Further Notice* correctly acknowledged that the FCC should carefully tailor performance requirements to accommodate the diverse services 5G will deliver, but service-specific requirements may not reflect the developments in 5G technologies even a few years from now. The FCC can account for the uncertainty in how 5G technologies will develop by eschewing restrictive performance requirements and instead adopting safe harbors for innovative and mixed use case deployments. This approach can be accompanied by limited case-by-case review and a procedure to review and recalibrate the safe harbors as the 5G ecosystem evolves.

The record supports this approach, with multiple commenters explaining that performance metrics will need to be flexible enough to accommodate the differing services that will be offered in the various bands that the FCC is targeting for 5G services.[37] In particular, the record establishes that the 5G ecosystem would be best served if the Commission waits to gain a

[37] *See* CTIA Comments at 16 ("Performance requirements should be crafted to reflect the evolving nature of 5G services and technologies so that licensees retain the flexibility needed to deploy innovative systems."); Comments of Southern Company Services, Inc., GN Docket No. 14-177, *et al.*, at 6 (filed Sept. 30, 2016) ("Southern Linc Comments") (explaining that because M2M, IoT, and other 5G services are "just emerging, it may be impractical, and unwise, to define specific numbers for the levels of devices, sessions, and data volume that would be appropriate milestones"); Comments of Consumer Technology Association, GN Docket No. 14-177, *et al.*, at 5 (filed Sept. 30, 2016) ("CTA Comments") ("Build-out or other performance requirements should reflect the strengths and weaknesses of . . . specific spectrum bands.").

better understanding of how the equipment and engineering behind the Internet of Things ("IoT") and other 5G services are implemented before determining rigid performance metrics.[38]

To this end, there is a broad consensus that adopting safe harbors and guidelines are preferable to restrictive, technology-specific metrics. Adopting technology-neutral safe harbors and examples of how providers can meet these baseline requirements will provide confidence and certainty for licensees while enabling innovation. The Consumer Technology Association ("CTA"), for example, urged the FCC to consider adopting "multiple safe harbor benchmarks [to] reflect the wide range of uses of mmWave spectrum."[39] CTIA also proposed that the Commission adopt "non-exhaustive, representative safe harbor examples of the kinds of deployments that will satisfy the case-by-case performance milestone analysis" for services that do not meet either the Commission's fixed or mobile benchmarks.[40] Straight Path similarly agreed that safe harbor guidelines as well as guidance on how the Commission will evaluate 5G fixed and mobile deployments will benefit licensees.[41] Southern Linc, too, suggested that the Commission publish guidelines for demonstrating compliance.[42]

As Nextlink explained in its comments, a technology-neutral safe harbor of one "installation" or "system" per license area for each of the bands for new technologies and mixed

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[38] *See, e.g.*, Comments of Competitive Carriers Association, GN Docket No. 14-177, *et al.*, at 7 (filed Sept. 30, 2016) ("CCA Comments") ("[A]dopting performance metrics . . . must be postponed until both stakeholders and the Commission better understand how IoT-type services may be implemented, both from an equipment availability and engineering standpoint."); CTIA Comments at 17 ("[B]ecause it is unclear what form IoT deployments will ultimately take, crafting unique measurement milestones would be both difficult and premature.").

[39] *See* CTA Comments at 5.

[40] *See* CTIA Comments at 3-4.

[41] *See* Straight Path Comments at 11.

[42] *See* Southern Linc Comments at 7.

use deployments would afford licensees the flexibility to deploy the services and technologies that are ready for launch, rather than prioritizing deployment to meet a requirement that may not reflect the nature of the products and services coming to market.[43] End users will not fully enjoy the benefits of 5G deployments if carriers must focus on optimizing deployment benchmarks rather than network value and user experience. Nextlink also proposes that the FCC limit its use of case-by-case review to primarily address changes in technology or circumstances beyond a licensee's control. Less predictable case-by-case reviews would increase uncertainty, chill investment and deployment, and impose significant administrative burdens on both the Commission and licensees.[44]

### B. Stakeholders support the adoption of a recalibration mechanism to ensure the FCC continues to update its performance requirements to reflect the 5G marketplace.

The Commission should adopt a procedure that facilitates periodic review and recalibration of its safe harbors to help ensure that its performance requirements remain appropriate. The recalibration mechanism will provide the FCC the flexibility to accommodate unforeseen UMFUS developments and will also place industry stakeholders on notice that the FCC will review and likely adjust its performance requirement framework as the 5G marketplace develops.

The record establishes broad support for Nextlink's proposal to include a recalibration mechanism as part of the FCC's performance requirement framework. Like Nextlink,

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[43] The Commission's proposed approach, *Further Notice* ¶ 470, may unintentionally force mixed use licensees to deploy more services than a single-use licensee is required to deploy.

[44] *See* Straight Path Comments at 11 ("[L]icensees and the public are best served by clear regulatory guidance" like the safe harbor guidelines provided by the Commission for incumbent 28 GHz and 39 GHz licensees).

commenters strongly support the *Further Notice's* proposal that any list of performance metrics not be considered exhaustive, and they urge the FCC to make clear that any benchmarks, safe harbors, or guidelines adopted are subject to revision to reflect the changing 5G landscape. For example, the Competitive Carriers Association ("CCA") urges that "any new regulations should be as forward-looking as possible and include opportunities to revisit the rules as technology and commercial use of each band evolves."[45] Similarly, Straight Path and CTIA urge the FCC to clarify that its safe harbor list is "non-exhaustive and may change over time as technology advances."[46]

Nextlink's proposal for a recalibration mechanism fulfills the objectives of these and other commenters. The FCC should adopt a procedure that assesses the state of 5G services every five years and recalibrates the FCC's performance requirement framework accordingly. The process could include a notice-and-comment period during which stakeholders could offer comments on the effects of the FCC's current framework and proposals for how to improve it. If the record establishes that the current approach is no longer appropriate, the Commission should recalibrate its safe harbors or other metrics to better accommodate 5G technologies. Relying on guidance from stakeholders on the front-lines of 5G innovation will help ensure that the FCC's performance requirements continue to adequately reflect 5G developments and are not overly burdensome.

[45] *See* CCA Comments at 2.

[46] CTIA Comments at 18; *see* Straight Path Comments at 11 (proposing the Commission should "retain the flexibility for licensees to be able to demonstrate that the service they provide is 'substantial' even if it does not meet the safe harbor guidelines").

At a minimum, the record confirms that the FCC should reject calls to adopt utilization-based performance metrics. Starry, one of the few commenters supporting strict performance requirements, urges the FCC to adopt a metric for tracking spectrum usage based on the aggregation of bits of payload data, scaled by total bandwidth.[47] But adopting one particular metric, particularly one based on "actual use," will not accommodate many of the technologies that are envisioned for 5G, let alone use cases that have not yet been envisioned.[48] Machine-to-machine communications supporting services like power grids, for example, provide public benefits to residents and businesses in their service area, but likely would not meet a use-driven performance requirement.[49] Other 5G services that are focused on adding capacity and high-speed data, rather than coverage, also likely would fail to meet a utilization requirement.[50] Adopting proposals like those advanced by Starry would deter investment in important technologies that are not designed for a large number of sessions, users, or devices.

Further, such performance requirements may force licensees to share their spectrum under a use-or-share regime, even if those licensees in fact are using their spectrum, but simply not as defined by the particular utilization formula devised by the FCC. The FCC therefore

[47] *See* Comments of Starry, Inc., GN Docket No. 14-177, *et al.*, at 5 (filed Sept. 30, 2016) ("Starry Comments") (urging the Commission to "strengthen [its] performance requirements by including a utilization metric that aggregates all bits of payload data for any devices in any measurement, scaled by the total bandwidth, to ensure not just minimal utilization of the spectrum, but productive, active use of the spectrum").

[48] *See* Comments of Nextlink Wireless LLC, GN Docket No. 14-177, *et al.*, at 20-22 (filed Sept. 30, 2016) ("Nextlink Comments").

[49] *See* Southern Linc Comments at 4-6.

[50] *See* Nextlink Comments at 21.

should adopt a flexible approach to avoid inadvertently adopting inaccurate or poorly tailored performance requirements at this early stage in 5G development.

### C. The FCC should extend the date for existing licensees to demonstrate fulfillment of any performance requirements.

As Nextlink noted in its comments, not adopting mobile service rules for the entire LMDS band will create confusing and burdensome regulatory requirements for licensees, particularly in light of current deployments that span across the A1 and A2 bands.[51] At a minimum, "[a]ligning the license terms will provide more certainty for equipment manufacturers and will help minimize some of the inefficiencies resulting from orphaning portions of the LMDS band."[52] Nextlink again urges the Commission to harmonize the deadline for demonstrating compliance with its performance requirements for licensees throughout the 28 GHz band. Specifically, the FCC should allow A2 and A3 band and B block licensees to demonstrate fulfillment of the Commission's performance requirements by the same date as incumbent A1 band licensees, or by June 1, 2024.[53]

## III. A WIDE ARRAY OF COMMENTERS REJECT APPLICATION OF UNTESTED "USE-OR-SHARE" RULES FOR ADDITIONAL UMFUS BANDS.

The record establishes that dynamic spectrum sharing has not been sufficiently tested or developed in the bands identified in the *Further Notice*, and the Commission should not move forward with its use-or-share proposal at this time. Indeed, mobile network operators, equipment manufacturers, and trade associations oppose use-or-share rules with near unanimity. The few commenters who support sharing fail to grapple with the practical issues that sharing would

[51] *See id.* at 10.

[52] *Id.* at 11.

[53] *Report and Order* ¶ 220.

present. If, however, the FCC does press forward with a use-or-share regime in the face of the significant opposition in the record, the rules for the regime should adequately protect incumbent licensees and promote innovation and investment in the UMFUS bands.

### A. Parties soundly oppose use-or-share rules for the vast majority of spectrum bands identified in the *Report and Order* and *Further Notice*.

Many commenters agree with Nextlink that the FCC should reject use-or-share rules for most mmWave spectrum bands, particularly dynamic sharing policies. Use-or-share rules will dampen investment in the mmWave bands and add unnecessary complexity to a nascent and rapidly evolving service.[54] As Nokia notes, "[g]iven the variety of mmWave deployment configurations, the narrow beamwidths and propagation in these bands, a [Spectrum Access System] . . . could prove to be either ineffective or inefficient."[55] Several commenters also question whether UMFUS licensees could quickly displace sharing operators once a licensee decides to deploy service over the shared spectrum, undermining the primary benefit of sharing frameworks.[56] Well-defined procedures are essential to protecting UMFUS auction revenues and licensees' investment-backed expectations once they have purchased the licenses. At a minimum, the FCC's rules must clearly delineate the timing for opportunistic users to clear out of licensed spectrum once the licensee invokes its right to begin using the spectrum.[57] As Intel

[54] *See* CCA Comments at 6; CTIA Comments at 19-21; Ericsson Comments at 19-20; Comments of Intel, GN Docket No. 14-177, *et al.*, at 19-20 (Sept. 30, 2016) ("Intel Comments"); Comments of Mobile Future, GN Docket No. 14-177, *et al.*, at 5-6 (Sept. 30, 2016) ("Mobile Future Comments"); Nokia Comments at 11-14; Qualcomm Comments at 15; Straight Path Comments at 10; TIA Comments at 19.

[55] Nokia Comments at 11-12.

[56] *See* T-Mobile Comments at 24; TIA Comments at 19.

[57] Verizon Comments at 3-4.

recognizes, the FCC "potentially puts the U.S. market leadership advantage [in mmWave 5G] at risk with the delays [caused by] propositions like use-it-or-share-it."[58]

Use-or-share is also inconsistent with the FCC's well-established secondary market rules and policies. Microsoft, for example, concedes that secondary markets function well today and efficiently manage spectrum use but nevertheless urges the FCC to adopt a use-or-share regime as a "complementary approach."[59] But licensees purchase spectrum at auction for fair market value and should not be stripped of their rights without compensation. Microsoft's proposal, if adopted, would undermine robust participation in auctions for primary licensing rights in UMFUS spectrum bands.[60] A use-or-share framework therefore would undermine, rather than "complement," the FCC's existing secondary market rules. Moreover, the FCC can support unlicensed use of mmWave bands without jeopardizing the long-term viability of bands allocated for mobile services. The *Report and Order* created a contiguous 14 gigahertz band of unlicensed spectrum that the unlicensed community is more likely to prioritize for near-term growth over more contingent, encumbered mmWave bands.[61]

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[58] Intel Comments at 19; *see also* Nokia Comments at 10 ("The Commission should be commended for working at the regulatory equivalent of light-speed in this high-band proceeding. At the same time, the Commission should not propose sharing arrangements that will delay or even jeopardize commercial deployments in the mmWave bands.").

[59] Comments of Microsoft Corp., GN Docket No. 14-177, *et al.*, at 14 (filed Sept. 30, 2016) ("Microsoft Comments"). According to Microsoft, "[a] use-or-share rule serves the same function as a secondary market in increasing the efficiency of spectrum usage, except that the licensee cannot extract the additional value it can in a secondary market transaction." *Id.*

[60] *Accord* 5G Americas Comments at 21-22; CCA Comments at 8-9.

[61] *See* Intel Comments at 17 ("Users of mmW spectrum are unlikely to choose to use this geographically restricted and operationally encumbered 'use-it-or-share-it' spectrum to emulate a makeshift substitute for unlicensed access, since the Commission just created significant reserves of *dedicated* unlicensed mmW spectrum") (emphasis in original); *see also* CTIA Comments at 22; Mobile Future Comments at 6; Qualcomm Comments at 15; Straight Path Comments at 9.

Facebook claims that licensed spectrum resources are underutilized in parts of the world and therefore "[i]f unused spectrum [in the 37 GHz band] were instead open for unlicensed access through sharing technologies, this would no longer be a concern."[62] This argument does not hold water in the United States. According to CTIA, the U.S. is one of the most efficient users of mobile broadband spectrum, as more subscribers are served per megahertz of spectrum allocated for mobile use in the U.S. than in many other countries around the world.[63] Whatever the benefits of sharing outside the U.S., this is not a valid reason for exposing licensed operators in this country to potential interference caused by unlicensed use of these nascent bands.

NCTA supports authorizing widespread indoor unlicensed operations and asserts that "indoor low-power unlicensed use poses very little risk of harmful interference to incumbents in these bands due to the limited propagation of millimeter wave spectrum."[64] But Nextlink currently operates a mmWave-based network and can attest that NCTA's prediction substantially understates the likelihood of harmful interference. For example, when Nextlink cannot install its equipment on a rooftop (due to landlord objections, permitting difficulties, or other issues), Nextlink has resorted to interior installations, with one end of the microwave link located in-building and wirelessly connected through an exterior window to the remote unit. In Nextlink's experience, mmWave spectrum is capable of propagating through certain glass, thinner exterior walls, and (intermittently) through the opening and closing of structural exposures like doors and windows. In other words, normal building construction does not necessarily contain the

[62] Comments of Facebook, Inc., GN Docket No. 14-177, *et al.*, at 7 (filed Sept. 30, 2016).

[63] *See, e.g.*, Comments of CTIA – The Wireless Association®, WT Docket No. 13-135, at 67 (filed June 17, 2013).

[64] NCTA Comments at 20.

unlicensed signals, which can propagate beyond the building footprint, and can cause harmful interference to licensed services.

In sum, the few proponents of sharing have failed to grapple with the significant technical and practical challenges of sharing in mmWave bands, particularly given the high level of uncertainty in how services will develop in these bands. By contrast, moving forward with sharing rules at this time could substantially impede the development of innovative services and undermine U.S. leadership in 5G. As wireless technology consultant Peter Rysavy recently surmised:

> [Dynamic sharing] will be the most complex spectrum management system ever developed. We don't know how well it will work or whether anybody will even use the resulting system. Until it has been deployed, tested, proven to work technically, and most important of all, proven to support effective business models, we should not be designing it into other bands and unnecessarily placing those bands at risk.[65]

### B. If the FCC pursues its risky use-or-share proposal, then it should limit its experimentation to the 24 GHz or 37 GHz bands and adopt rules that protect innovation and investment in the other mmWave bands.

If the FCC decides to require licensees to engage in experimental sharing in the mmWave bands, notwithstanding the strong opposition in the record, then it should, at a minimum, limit the number of bands it targets for sharing. Most use-or-share supporters have limited their support to the 24 and 37 GHz bands.[66] Nextlink urges the FCC to keep any use-or-share rules

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[65] *See* Peter Rysavy, *Analyst Angle: 3.5 GHz and 5G – Learning from the TV White Space Debacle*, RCRWIRELESSNEWS (Aug. 10, 2016), http://www.rcrwireless.com/20151111/analyst-angle/5g-promises-and-pitfalls.

[66] *See, e.g.*, Comments of Dynamic Spectrum Alliance, GN Docket No. 14-177, *et al.*, at 6 (filed Sept. 30, 2016) (supporting sharing in the 24 and 37 GHz bands as well as the 39 GHz band as long as licensees "'retain the primary right to construct and provide service anywhere within [their] license area at any time'" (citing *Further Notice* ¶ 462)); Comments of Google Inc. and Google Fiber Inc., GN Docket No. 14-177, *et al.*, at 6-11 (filed Sept. 30, 2016) ("Google

confined to the 24 and 37 GHz bands—at least for now. With all the uncertainty commenters have raised around use-or-share, industry stakeholders would benefit from an initial roll-out of the framework in a limited number of bands to evaluate how the rules are implemented and what problems (if any) the framework creates. Nextlink also agrees with the Fixed Wireless Communications Coalition that licensees should be allowed to participate in a use-or-share framework to the same extent as other stakeholders.[67] In addition, the FCC should adopt rules that incentivize service providers to bid on mmWave spectrum at auction and invest in those bands.

### 1. Traditional coordination or exclusion zones are preferable to untested dynamic access models.

The FCC should "not view [SAS] concepts as a panacea."[68] As AT&T notes, the Spectrum Access System ("SAS") model for dynamic sharing is "still untested," and "there are already significant issues coming to the fore as industry struggles with SAS implementation for the 3.5 GHz band."[69] Nextlink agrees that more reliable and tested methods such as coordination

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Comments"); *see also* 5G Americas Comments at 14 ("Aside from the 37-37.6 GHz Lower Band Segment (LBS), where the Commission has already ruled there will be a license-by-rule sharing framework, there should be no mandated sharing in any form or by any name, in any of the exclusively licensed bands.").

[67] Comments of the Fixed Wireless Communications Coalition, GN Docket No. 14-177, *et al.*, at 15 (filed Sept. 30, 2016) ("FWCC Comments"). Indeed, licensees should have a right-of-first-refusal to access spectrum made available through use-or-share rules. *See* Verizon Comments at 3-4.

[68] AT&T Comments at 11; *see also* Comments of O3b Limited on Further Notice of Proposed Rulemaking, GN Docket No. 14-177, *et al.*, at 16-17 (filed Sept. 30, 2016) ("O3b Comments").

[69] AT&T Comments at 11.

and exclusion zones and prior coordination notices or pre-defined geographic areas available for shared access are preferable to dynamic sharing through a SAS model.[70]

Additionally, the coordination or exclusion zone or pre-defined geographic area that protects the licensee's operations from sharers must account for the technical realities of mmWave spectrum and allow the licensee to expand its network footprint in the future. In the *Further Notice* the FCC proposed that if a network operator deployed service in 40 percent of the geographic area of a census tract, then the tract would be considered "in use" and not subject to sharing.[71] Nextlink agrees that 40 percent deployment in a geographic area is a good benchmark for actual use. O3b's proposed "actual use" threshold of 80 percent of the geographic area is double the size of the FCC's benchmark and would risk opening a tract to shared access when a significant portion of the geography (and population) are served by a UMFUS licensee.[72] The FCC should reject O3b's proposed benchmark.

**2. Use-or-share access should not apply immediately.**

Open Technology Institute at New America ("OTI") and Public Knowledge ("PK") ask the FCC to open-up the mmWave bands to opportunistic access "even prior to an auction for licenses if a SAS is certified and the temporary users will not cause harmful interference to incumbent band licensees."[73] OTI and PK's proposal is based on dubious assumptions and threatens to seriously undermine fair use of spectrum resources.

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[70] *Id.* at 11-12.

[71] *Further Notice* ¶ 481.

[72] O3b Comments at 14 n.23.

[73] Comments of Open Technology Institute at New America and Public Knowledge, GN Docket No. 14-177, *et al.*, at 19 (filed Sept. 30, 2016) ("OTI-PK Comments").

First, OTI and PK assume that the untested and unproven dynamic sharing system will allow a licensee to easily remove an opportunistic user from the shared portion of the license area once the licensee deploys service—which may or may not be possible.[74] Further, OTI and PK dismiss the costs that licensees will bear as a result of a use-or-share framework.[75] In particular, OTI and PK do not account for the costs licensees will bear should a disagreement arise concerning the licensee's deployment of service in the area or the accuracy of the information a sharing party submits to the sharing database (an issue that has plagued the TV white space databases).[76] Finally, OTI and PK do not consider the significantly reduced participation in auctions that granting immediate, opportunistic access to mmWave spectrum would cause. Providing immediate access to mmWave spectrum on a use-or-share basis raises several concerns, and Nextlink recommends against adopting such a rule.

### 3. The FCC should reject attempts by the satellite industry to craft *de facto* primary rights in the 28 GHz band.

Several satellite companies urge the FCC to adopt use-or-share rules that would essentially elevate Fixed Satellite Service ("FSS") to co-primary status. The FCC has repeatedly rejected FSS operators' arguments that they should be afforded such protection and should not give credence to these back-door attempts to obtain a preferred classification.

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[74] *See supra* note 56 and accompanying text.

[75] OTI-PK Comments at 18-19.

[76] *See* Amy Schatz, *FCC's Hot Mess of a Database May Not Bode Well for Future Airwaves Sharing*, RECODE (Mar. 17, 2015), http://www.recode.net/2015/3/17/11560372/fccs-hot-mess-of-a-database-may-not-bode-well-for-future-airwaves.

For example, O3b asks the FCC to grant FSS earth stations deployed under a use-or-share regime the same protected status as grandfathered stations deployed in the 28 GHz band.[77] O3b claims that "[o]nce built, a 28 GHz earth station should not be required to modify or cease operations for the benefit of future UMFUS expansion or for any other operations authorized in the band."[78] O3b's proposal is not use-or-share; rather, it is an effort to modify the U.S. Table of Allocations and peremptorily grant satellite operators co-primary status in the 28 GHz band. O3b's proposal, if adopted, would threaten the long-term viability of mobile 5G services in the 28 GHz band because satellite operators would be able to leverage their grandfathered status to flood the band with stations before 5G standards are finalized.

Similarly, ViaSat supports requiring terrestrial operators to submit information on their network deployments "that could be used to determine whether satellite user equipment could operate without receiving interference."[79] ViaSat claims that it would operate in additional mmWave bands on a non-protected basis, but would have the FCC require licensees to provide "salient" technical information such as the location, elevation, frequencies, polarization, power level, antenna gain, and transmission paths of their operations.[80] While such a database may work in the 37 and 39 GHz bands or other mmWave bands licensed based on Partial Economic Areas, the FCC should not expand FSS operators' access to smaller, county-based 28 GHz band license areas. Moreover, the Commission's decision to bifurcate the 28 GHz A1 band and license it on a county basis means that FSS operators have plenty of opportunities to acquire the

[77] O3b Comments at 15.

[78] *Id.*

[79] Comments of ViaSat, Inc., GN Docket No. 14-177, *et al.*, at 19 (filed Sept. 30, 2016).

[80] *Id.* at 19-20.

exclusive primary rights that come with licensed spectrum through auction, the secondary market, or disaggregation. Nextlink does not support the creation of a proprietary, third-party database for the sole benefit of the FSS community (presumably operated and maintained at UMFUS licensees' expense), and urges the FCC to reject ViaSat's proposal as well.

## IV. THE COMMISSION SHOULD NOT ADOPT RESTRICTIVE TECHNICAL REQUIREMENTS THAT MAY HAMPER DEVELOPMENT OF 5G TECHNOLOGIES

Because 5G services remain in such a nascent state, the Commission should allow technologies supported by the UMFUS bands to develop more fully before adopting any particular technical framework for these next-generation services. An approach established today may not anticipate changing technologies, particularly given the diverse deployment models and services envisioned for mmWave spectrum.[81] Nextlink offers several scenarios where the Commission should refrain from imposing unnecessary technical restrictions.

### A. The FCC should not impose antenna restrictions, including height limitations or downtilt requirements.

The Commission should encourage innovation and experimentation by refraining from adopting restrictive antenna requirements. The record establishes strong opposition to the Commission mandating antenna downtilting[82] or specific antenna height limitations.[83] Ericsson, for example, explains that system designers and operators are already using downtilt where it is needed, and a downtilt mandate is unnecessary.[84] Other commenters propose that smaller fixed

[81] *See, e.g.*, CCA Comments at 9-10; CTA Comments at 6 (supporting "baseline" technical rules not use of particular technology).

[82] *See* Ericsson Comments at 3, 20; 5G Americas Comments at 24.

[83] *See* 5G Americas Comments at 8; Qualcomm Comments at 14-15.

[84] *See* Ericsson Comments at 20.

antennae should be allowed because they would permit wider beamwidths, which would provide opportunities for deployment that will serve public venues with 5G backhaul services.[85] Both 5G Americas and Qualcomm urge the Commission to allow antenna height and downtilt to be flexible so that licensees can use these variables as tools to promote the development of new architectures.[86] As these stakeholders note, licensees will have appropriate incentives to work together to protect each other in the same service areas, and to meet the power level at a given border to protect adjacent operators.[87] Nextlink supports these proposals and the underlying objective to permit 5G technologies to develop free from unnecessary restrictions.

### B. The FCC should reject calls to impose minimum bandwidth requirements for mobile and transportable station transmit power levels.

The Commission should reject proposals to adopt restrictions regarding UMFUS device effective isotropic radiated power ("EIRP") density for mobile and transportable stations. For instance, Boeing recommends that the Commission adopt power limits based on EIRP densities of 43 and 55 dBm per 100 MHz for UMFUS mobile and transportable CPEs, respectively, and asserts that "[f]ailure to do so would invalidate the technical assumptions and analyses presented in this docket by both the 5G community and the satellite industry."[88] However, Boeing mischaracterizes the analyses performed by the 5G community. In its *Report and Order*, the Commission observes that there is strong support in the record for the proposed EIRP levels for

[85] *See* 5G Americas Comments at 8.

[86] *See* Qualcomm Comments at 14-15; 5G Americas Comments at 23-24.

[87] *See id.*

[88] *See* Comments of The Boeing Company, GN Docket No. 14-177, *et al.*, at 46 & n.55 (filed Sept. 30, 2016); *see id.* at 45-47.

mobile stations and cites in-depth analyses provided by Intel, Nokia, and Straight Path.[89] Contrary to Boeing's assertions, all of these analyses assume absolute EIRP levels for mobile stations, not EIRP densities.[90]

Further, the Commission explains that its new rules are consistent with the FCC's Part 15 rules, which also establish EIRP limits, not densities.[91] Similarly, in its *Further Notice*, the Commission seeks comment on the power limits it should establish for mobile and transportable stations supporting 5G services. To provide context for the input it seeks, the Commission references its Part 27 rules for mobile devices, which also do not have bandwidth scaling (and impose EIRP limits), and distinguishes those rules from the rules for fixed and base stations, which are scaled (and impose EIRP densities).[92] The Commission does need to fix inconsistent language, however, in Appendix G.[93]

There is widespread support in the record for retaining the existing rules for mobile and transportable stations, and only limited support for bandwidth scaling. 5G technology is nascent,

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[89] *See Report and Order* ¶¶ 281-87.

[90] *See Report and Order* ¶ 282 (citing Reply Comment of Intel Corporation, GN Docket No. 14-177, *et al.*, at 19, Appendix A at 22-28 (Feb. 26, 2016); Comments of Nokia, GN Docket No. 14-177, *et al.*, at 27-28 (Jan. 27, 2016); Comments of Straight Path Communications, GN Docket No. 14-177, *et al.*, at Appendix A1-A3, 41-42; Reply Comments of Straight Path, GN Docket No. 14-177, *et al.*, at Appendix A Tables, 1, 2, and 3 (Feb. 26, 2016)).

[91] *See id.* ¶ 281.

[92] *See Further Notice* ¶ 508.

[93] Appendix G proposes densities, not power limits, for mobile and transportable stations. The Commission should issue an erratum to correct Appendix G because it clearly conflicts with the Commission's intended proposal, as explained in paragraphs 507, 508, and other parts of the *Report and Order* and *Further Notice. Compare Further Notice,* Appendix G, Proposed Rules §§ 30.202(b)-(c), *with Further Notice* ¶¶507-508; *Report and Order* ¶¶ 281-87; *id.* ¶ 283 n.735 ("Unlike the EIRP limit for base stations, this EIRP limit is not scaled depending on the signal bandwidth.").

and establishing power scaling factors based on bandwidth for transportable and mobile stations could inadvertently preclude some use cases that are not yet developed, as well as some that are already envisioned.[94] As T-Mobile stated, the Commission should "avoid hampering future developments" by declining to adopt a minimum bandwidth for base stations, portable devices, or mobile devices.[95]

### C. Coordination at market borders for fixed point-to-point operations should not be based on distance alone.

The current coordination distances that apply under the Commission's rules are incongruent with county-based licensing. The Commission should adopt alternatives to the existing coordination distances for fixed point-to-point operations that reduce the burdens of coordinating fixed links.

The record reveals support for alternative proposals, like Nextlink's, to the existing coordination distances.[96] For example, Starry agrees with Nextlink that existing coordination distances are no longer appropriate given licensees' smaller market area sizes and should be reduced.[97] Starry and Nextlink both urge the Commission to consider more than just distance among its coordination criteria, in light of the poor fit between existing coordination distances and license sizes.[98]

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[94] Further, specific absorption rate ("SAR") limits will likely determine the maximum power limits for mobile devices, regardless of scaling. *See* Nextlink Comments at 30.

[95] T-Mobile Comments at 31.

[96] *See* Nextlink Comments at 30-31.

[97] *See id*; Starry Comments at 7.

[98] *See* Nextlink Comments at 31; Starry Comments at 7.

For example, at 28 GHz the Commission could use the free space path loss ("FSPL") at 20 kilometers of 147.4 dB and set 20 km as the coordination distance in the direction of the antenna's maximum gain. Then for all other directions, the difference in gain from the maximum could be subtracted from 147.4 dB, and the FSPL formula used to calculate applicable coordination distances for the resulting value of path loss. Thus, a relative coordination distance would be calculated in all directions in which the antenna has less than maximum gain, based on the antenna's horizontal pattern. This would give a coordination zone based on the antenna pattern, and if this zone intersects another market, then the licensee would need to coordinate the station with the licensee in that neighboring market. Amending the current approach by taking relative power levels into account would benefit operators by helping more accurately project when coordination with neighboring markets is necessary.

While Starry's approach also takes more than distance into account, as Nextlink proposes, it departs from the spirit of the Commission's coordination rules. Starry proposes establishing a contour zone, which begins to resemble an interference protection scheme that would be overly complex and burdensome for licensees.[99]

Nextlink's approach is a better alternative than either adopting the existing fixed radius coordination distances or adopting Starry's proposal while furthering the same goals. Nextlink's proposal would produce a coordination zone that more realistically represents the possibility that the station could cause interference to stations in a neighboring market, thereby reducing the burdens of coordinating fixed links. Similar to the current fixed radius rule, this approach also omits terrain from the calculation to simplify the process and reduce coordination burdens.

[99] *See* Starry Comments at 7.

### D. The Commission's operability requirement should not mandate that equipment operate on all air interfaces in a band or between bands or subject a provider to conflicting rules.

In its *Report and Order*, the Commission mandated that mobile and transportable equipment operating within each mmWave band be operable across the entirety of each band in which it operates, with each air interface it uses in that band or bands.[100] There is support in the record for the Commission's decision to adopt "operability," not "interoperability," requirements for devices operating in the UMFUS bands.[101]

The Commission recognized that "there was some confusion" regarding its proposals, and attempted to clarify its adopted requirements in the *Report and Order*.[102] However, the Commission should explicitly clarify that a device will not have to meet conflicting rules if they arise in a particular band.[103] Specifically, the Commission should make clear that its operability requirement does not apply to equipment operators that have already deployed across bands. The Commission should also clarify when and to what deployments its new operability rules will apply.

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[100] *See Report and Order* ¶¶ 321-22. "Operability" is defined as a requirement that equipment be capable of operating across the entire band, and is different from an "interoperability" requirement that equipment operate across multiple air interfaces. *See id.* ¶ 322 n.850.

[101] *See* Reply Comments of United States Cellular Corporation, GN Docket No. 14-177, *et al.*, at 12, 16-17 (filed Feb. 26, 2016); *see also* Comments of CTIA – The Wireless Association®, GN Docket No. 14-177, *et al.*, at 30-31 (filed Jan. 28, 2016) (seeking clarification on the Commission's proposal and opposing an *inter*operability requirement that would mandate operability across all air interfaces); T-Mobile Comments at 30-31 (same); Qualcomm Comments at 30-31 (same).

[102] *See Report and Order* ¶¶ 320-324.

[103] Commenters including CTA agree that this clarification is necessary. *See* CTA Comments at 6-7.

The FCC's operability requirement may also have unintended consequences for 5G services. To realize the promise of 5G, operators must be able to backhaul data from small cells. The backhaul solution in many cases will be wireless. The Commission envisioned that the UMFUS bands would be used for both mobile broadband access and for mobile broadband backhaul.[104] Depending on how 5G services are implemented, a mix of services offered in a given band could be at odds with an operability requirement. For example, some licensees may choose frequency segmentation such that part of the band is used for mobile access and part used for backhaul. However, the operability rule requires mobile and transportable devices to be designed in a way that enables access to the entirety of the band, including the segment used for backhaul. If mobile broadband access devices are not able to filter the strong signals from backhaul transmitters, then they will likely be exposed to overload interference when operating in close proximity to wireless backhaul devices. Solutions such as dynamic filtering would add complexity and cost to devices and would add technical risk to device development.

In many bands, an operability requirement can help promote a robust market for equipment in each band, and can help ensure that equipment is available equally to all licensees. However, given the nascent state of 5G and the unknowns associated with 5G deployments, the Commission should not upset the balance by imposing requirements that are unnecessarily restrictive and may have unintended, negative consequences for 5G deployments.

## CONCLUSION

A variety of commenters urge the Commission to look beyond the bands identified in the *Further Notice* to additional frequencies that can support 5G service. Nextlink encourages the

[104] *See, e.g., Report and Order* ¶¶ 6-7, 161, 270.

Commission to give such consideration to the 28 GHz A2 and A3 bands and B block. No commenter has objected to identifying these valuable, strategically located swaths of spectrum for 5G mobile service and technical solutions are available to maximize the utility of these bands. Commenters also agree that clear, up-front performance safe harbors for 5G use cases that are periodically reevaluated will provide licensees with an appropriate balance of flexibility and certainty. Likewise, Nextlink supports the many commenters that have expressed concern with applying untested "use-or-share" rules to multiple UMFUS bands.

With the right rules and policies in place, the United States can succeed in the development and deployment of 5G services in the same way it succeeded in 4G LTE deployments. To lead the world, Nextlink urges the Commission to maximize the amount of spectrum made available for 5G and adopt technical and service rules that encourage innovation and investment in UMFUS bands.

Respectfully submitted,

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